

## PATENT ABSTRACTS OF JAPAN

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G02B 5/04

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(21)Application number : 06-117402

(71)Applicant : CANON INC

(22)Date of filing : 09.05.1994

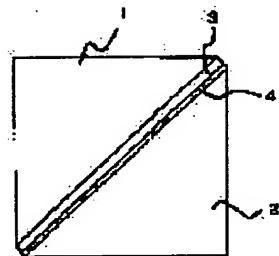
(72)Inventor : TANIGUCHI YASUSHI

## (54) PRODUCTION OF OPTICAL PART

## (57)Abstract:

PURPOSE: To obtain high adhesion strength, to avoid absorption of UV rays by the adhesive layer, and to prevent reduction of transmittance by adhering prisms comprising quartz glass with hydrolyzed product of silicon alcolate.

CONSTITUTION: In a polarizing beam splitter of a prism type, a prism 1 with a polarizing beam splitter film 3 is adhered to a prism 2 with a hydrolyzed product of silicone alcolate. The prisms 1, 2 consist of synthesized quartz, and the polarizing beam splitter film 3 formed on the prism 1 consists of a multilayer film of dielectric material formed by vacuum vapor deposition method or the like. The silicone alcolate changes into glass-like SiO<sub>2</sub> by hydrolysis to give adhesive property and does not substantially absorb UV rays. Further, since the hydrolyzed product of silicone alcolate has the same component as the quartz glass which constitutes the prisms, refractive indices of both materials is same and affinity between these becomes high to give high adhesion strength.



## LEGAL STATUS

[Date of request for examination] 09.05.1994

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 2786996

[Dat of registration] 29.05.1998

[Number of appeal against xamin r's decision  
of rejection]

[Date of requesting appeal against examiner's  
decision of rejection]

[Dat of extinction of right]

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**JAPANESE** [JP,07-005307,A]

**CLAIMS** **DETAILED DESCRIPTION** **TECHNICAL FIELD** **PRIOR ART** **EFFECT OF THE**  
**INVENTION** **TECHNICAL PROBLEM** **MEANS** **EXAMPLE** **DESCRIPTION** **OF DRAWINGS**  
**DRAWINGS**

[Translation done.]

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**CLAIMS**

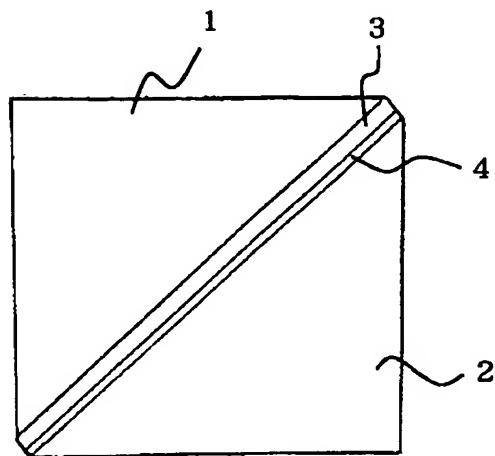
[Claim(s)]

[Claim 1] A manufacture method of an optic characterized by pasting up said prism comrade by hydrolysis product of silicon alcoholate in a manufacture method of an optic of having a production process which sticks a prism comrade who consists of quartz glass.

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[Translation done.]

Drawing selection  R pres ntativ drawing



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JAPANESE [JP,07-005307,A]

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Industrial Application] This invention relates to the method of manufacturing an optic, by pasting up the optical element comrade for an ultraviolet-rays field using adhesives.

#### [0002]

[Description of the Prior Art] Conventionally, the adhesives of a balsam, an epoxy system, and an ultraviolet curing mold have been used for adhesion of the optical element used for a transmitted light study system, for example, a lens, and prism.

[0003] However, since these adhesives did not have the high light transmittance in an ultraviolet-rays field (wavelength of 200nm – 400nm), there was nothing that can be used to the optical element used in a field with a wavelength of 300nm or less. Moreover, as a result of adhesives' causing absorption to the high ultraviolet radiation of energy represented by the excimer laser, there was a defect that the lightfastness of adhesives was low and adhesion of an optical element could not be performed. For this reason, in the manufacture process of an optical element, when pasting up the optical element used in this wavelength field, the only method used optical contact. However, in order to carry out optical contact, it is required for the surface roughness of an adhesion side to be very small like 1/100 of wavelength. Therefore, it had to grind or the thin film was prepared on the optical element so that it might become smooth enough about the surface of an optical element, and although this thin film was intervened, the case had the defect that an adhesive property was bad.

#### [0004]

[Problem(s) to be Solved by the Invention] This invention is made in order to remove the defect of the above-mentioned conventional example, and the purpose is in offering the manufacture method of an optic of having used the new method of preparing the glue line which does not absorb the light of an ultraviolet region, and pasting up an optical element.

#### [0005]

[Means for Achieving the Goal] In order to attain the above-mentioned purpose, a manufacture method of an optic characterized by this invention pasting up said prism comrade by hydrolysis product of silicon alcoholate in a manufacture method of an optic of having a production process which sticks a prism comrade who consists of quartz glass is proposed.

#### [0006]

[Example] Hereafter, according to an example, this invention is explained in detail.

[0007] Drawing 1 is the mimetic diagram showing a prism type polarization beam splitter. One prism 2 with which the polarization beam splitter film 3 was formed and which will be rich prism 1 pastes up by the hydrolysis product 4 of Si-alcoholate, and this polarization beam splitter is formed.

[0008] Each prism consists of synthetic quartz, and the polarization beam splitter film 3 prepared on one prism 1 consists of the multilayers of a dielectric, and is formed of vacuum

deposition, a spatter, ion plating, etc. The spectral characteristic of this polarization beam splitter is shown in drawing 2. By drawing 2, 5 shows P component of a reflection factor and 6 shows S component of a reflection factor. In addition, this polarization beam splitter is KrF and for excimer lasers.

[0009] In order to paste up both the prism of the above-mentioned polarization beam splitter, Si-alcoholate is used in this invention. Si-alcoholate is vitrified SiO<sub>2</sub> by hydrolyzing. Since it becomes what becomes, and presents adhesion ability and does not absorb the light of an ultraviolet region substantially, it can use as adhesives in this way. And since the hydrolysis product of Si alcoholate and the quartz glass which constitutes prism are the same components, both refractive index is upwards in agreement, and strong adhesive strength also with both high compatibility is shown.

[0010] Although Si-alcoholate can use various things, it should just choose for example, ethyl silicate Si<sub>5</sub>O<sub>4</sub>12 (OC two H<sub>5</sub>) grade. however, others -- silicon tetra-ethoxide: -- Si (OC two H<sub>5</sub>)<sub>4</sub> etc. -- Si<sub>n</sub>On-1 represented by Si<sub>n</sub>On-12(OC two H<sub>5</sub>)<sub>n+2</sub> (OR)<sub>2n+2</sub> (for R, substitute or an unsubstituted hydrocarbon group, and n are one or more), and RnSi(OR)<sub>4-n</sub> etc. -- Si alcoholate can be used.

[0011] Especially a limit does not have the conditions of hydrolysis of Si-alcoholate which was illustrated above, and a catalyst, and they should just hydrolyze according to a conventional method.

[0012] Although the alcohol of a solvent or ester remains after hydrolysis, the alcohol of a low-boiling point and ester (for example, ethyl alcohol, a sulfate, etc.) volatilize after adhesion. If this is removed more positively, it can process by making into a vacuum whether to heat. Moreover, while cleaning an adhesion side enough in adhesion since bond strength falls or it becomes the cause of laser damage if foreign matters and impurities, such as dust and dust, exist in an adhesion side on the occasion of adhesion, filtrating and using adhesives etc. needs removal of an impurity. Especially as work environment, the clean room is suitable.

[0013] In order to paste up both prism, it is necessary to coat the lamination side of both prism with the hydrolysis product of Si-alcoholate but [ therefore ], and although the general method of it being dropped at the field of lamination, applying, for example, and pasting up can also be used, the following method is suitable in order to make a glue line thin to about 1 micrometer. That is, it is the method of joining both prism, pouring the hydrolysis product of Si alcoholate into the crevice using a syringe etc., and spreading a hydrolysis product over the whole plane of composition of both prism by capillarity. In this method, in order to extend Si alcoholate well on a plane of composition and to control thickness and a membranous formation speed, it is required to bring about the suitable viscosity for Si-alcoholate. This is realizable by dissolving metal alcoholate in the solution chosen suitably. As this solution, high-boiling point alcohol and ester, such as butyl alcohol, can be used, for example.

[0014] Generally, after hydrolysis, by heating, dehydration and a polymerization progress and Si-alcoholate is SiO<sub>2</sub>. It changes to an amorphous film and will become near with the material of an optical element. However, since this invention and an optical property equivalent to the case where a glue line heats even if it does not especially heat in this example are shown and practically sufficient adhesion ability is presented, there is no necessity for heating.

[0015] Various kinds of prism which can be conventionally used to a short wavelength field can be offered by applying this invention to manufacture of Gulan Thompson, Gulan Tiller, a wollaston prism, etc., and pasting up the component part by the hydrolysis product of Si-alcoholate.

[0016] Moreover, not only the optic on which the optical element comrade was pasted up but this invention is applicable also to manufacture of an optic and the optic which consists of a metal etc.

[0017] In addition, a mirror, a grating, etc. are included other than a lens and prism including all the things that achieve the operation to which condensing, reflection, refraction, interference,

etc. consider light as the optical element stuck by this invention. Therefore, the optical element completed by this invention contains widely what has the production process of lamination in a manufacture process.

[0018]

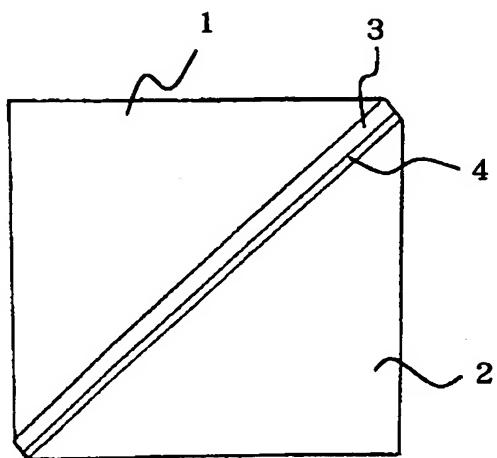
[Effect of the Invention] As explained to details above, in this invention using Si-alcoholate as adhesives of the optical element comrade who consists of quartz glass, adhesive strength is strong, moreover the refractive index of a glue line and an adhesion base harmonizes, and the optic with which there is no absorption of the ultraviolet radiation by the top glue line, and permeability does not fall can be manufactured. Moreover, in this invention, since adhesive strength of an optic cannot receive effect in the granularity of an adhesion side easily compared with the case where optical contact is used, this invention is applicable to manufacture of an extensive optic.

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[Translation done.]

Drawing selection

Representative drawing



[Translation done.]

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JAPANESE [JP,07-005307,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS  
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TECHNICAL FIELD

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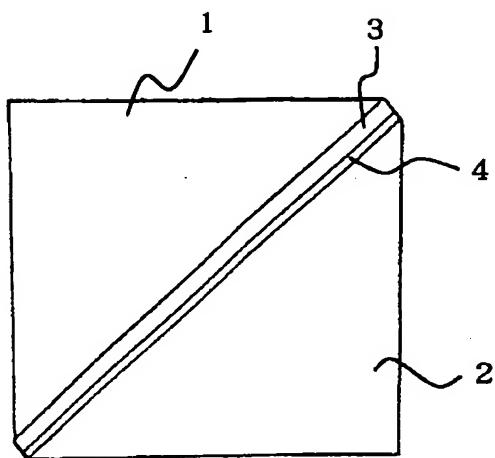
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R pres ntativ drawing



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PRIOR ART

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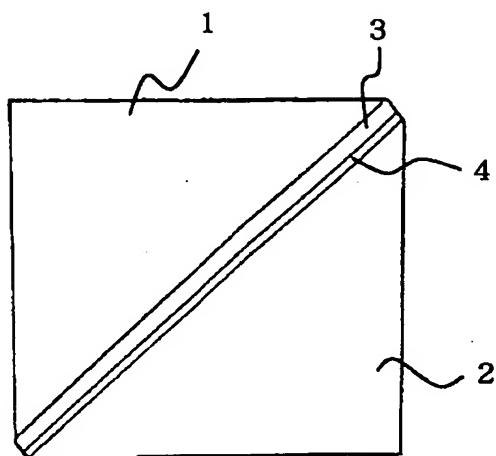
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Drawing selection  presentativ drawing



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EFFECT OF THE INVENTION

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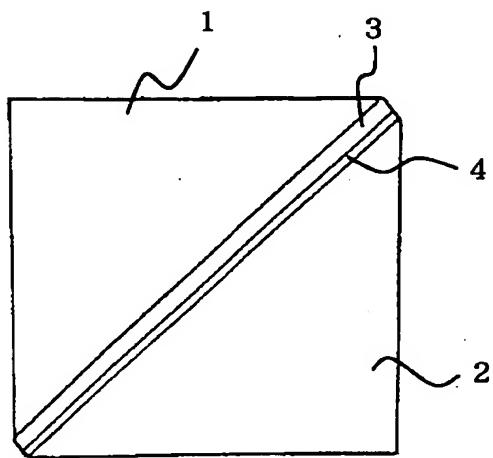
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TECHNICAL PROBLEM

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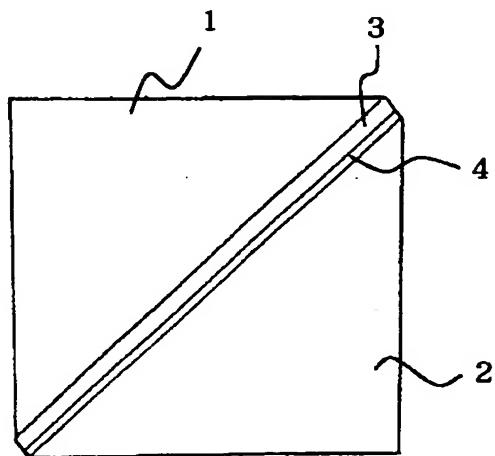
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Representative drawing



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MEANS

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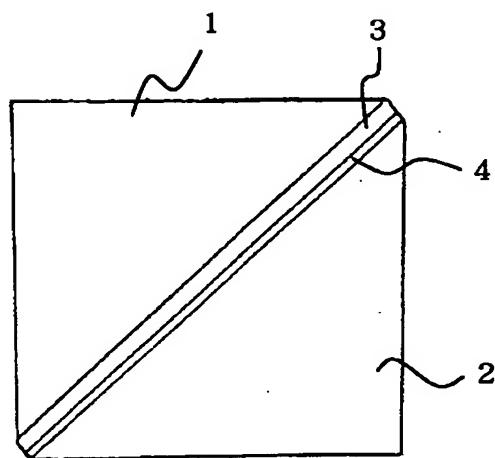
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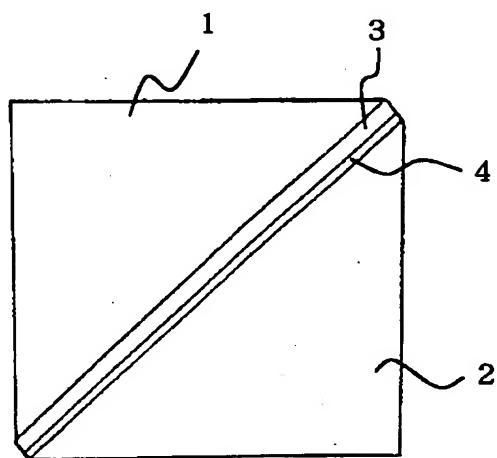
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[Translation done.]

Drawing selection

Representative drawing



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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the cross section of the polarization beam splitter of the prism type manufactured according to one example of this invention.

[Drawing 2] It is drawing showing the spectral characteristic of the polarization beam splitter of drawing 1.

[Description of Notations]

1 Two Prism

3 Polarization Beam Splitter Film Formed on Prism 1

4 Layer of Hydrolysis Product of Si-Alcoholate

5 P Component of Reflection Factor

6 S Component of Reflection Factor

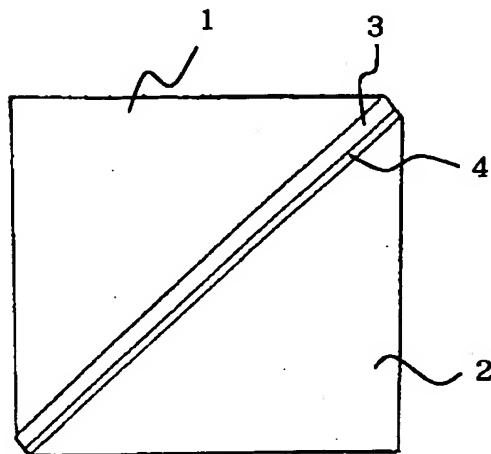
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Drawing selection

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P



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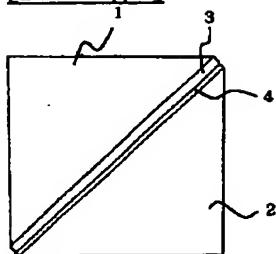
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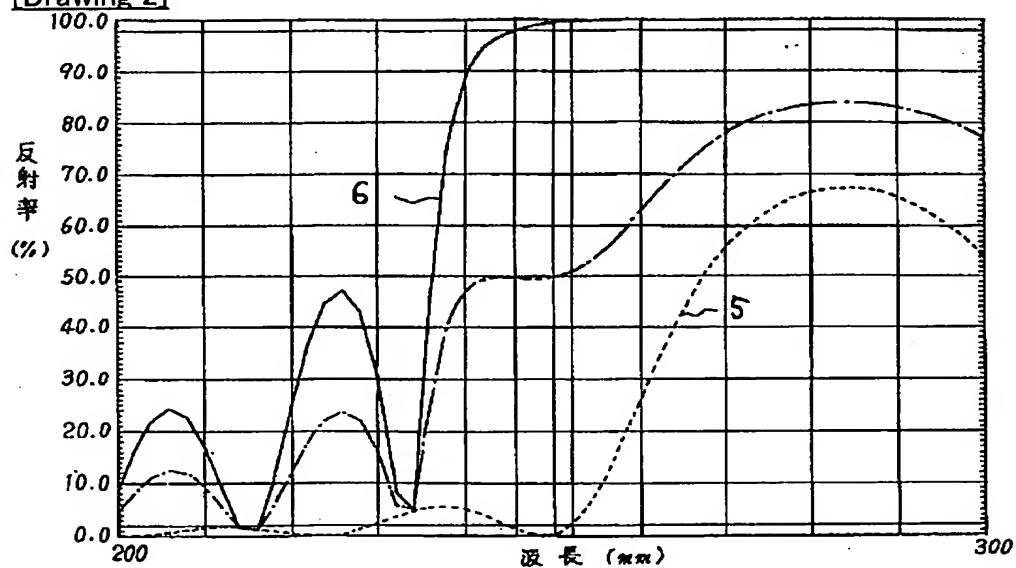
DRAWINGS

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[Drawing 1]



[Drawing 2]

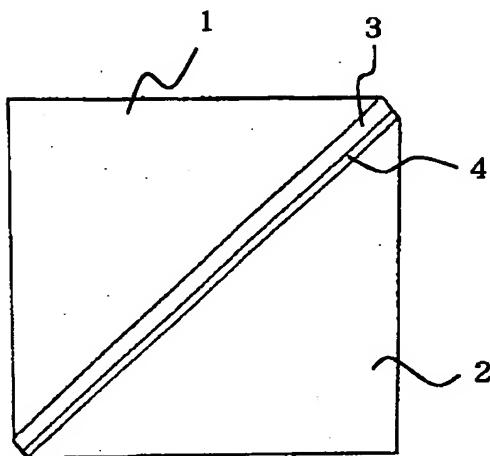


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[Translation done.]

Drawing selection

Repr s ntative drawing



[Translation done.]

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(19)日本国特許庁 (JP)

(12) 特許公報 (B2)

(11)特許番号

第2786996号

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(24)登録日 平成10年(1998)5月29日

(51)Int.Cl.<sup>6</sup>  
C03C 27/10  
C09J 183/00  
G02B 5/04

識別記号

F I  
C03C 27/10  
C09J 183/00  
G02B 5/04

E  
A  
Z

発明の数1(全3頁)

(21)出願番号 特願平6-117402  
(62)分割の表示 特願昭61-139975の分割  
(22)出願日 昭和61年(1986)6月18日  
  
(65)公開番号 特開平7-5307  
(43)公開日 平成7年(1995)1月10日  
審査請求日 平成6年(1994)5月9日

(73)特許権者 000001007  
キヤノン株式会社  
東京都大田区下丸子3丁目30番2号  
(72)発明者 谷口 靖  
東京都大田区下丸子3丁目30番2号 キ  
ヤノン株式会社内  
(74)代理人 弁理士 若林 忠  
  
審査官 鈴木 紀子

(56)参考文献 特公 平5-40798 (JP, B2)  
特公 平5-40799 (JP, B2)

(58)調査した分野(Int.Cl.<sup>6</sup>, DB名)

C03C 27/10  
G02B 5/04  
C09J 183/00

(54)【発明の名称】 光学部品の製造方法

(57)【特許請求の範囲】

1. 石英ガラスより成るプリズム同志を貼り合せる工程を有する光学部品の製造方法において、前記プリズム同志の接着を、シリコンアルコレートの加水分解生成物により行なうことを特徴とする光学部品の製造方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、石英ガラスより成るプリズム同志を、接着して貼り合せることにより光学部品を製造する方法に関する。

【0002】

【従来の技術】 可視光線領域から紫外線領域に亘り高い光透過率を示すガラスとして石英ガラスがある。この石英ガラスより成るプリズム同志を貼り合せてビームスプリッター等の光学部品を製造する際に、オプティカルコ

ンタクトによりプリズム同志を貼り合せる方法がとられている。オプティカルコンタクトを行う時には、接着面の表面粗さを波長の1/100程度の非常に小さい値にする必要があり、そのため、接着面を十分平滑になるよう研磨するか、接着面上に薄膜を設けなければならない。

【0003】

【発明が解決しようとする課題】 しかしながら、接着面を十分平滑になるように研磨する場合は光学部品の製造に手間がかかり、接着面上に薄膜を設ける場合には張り合せの際の接着性が悪くなるという問題が生じる。そこで本発明の目的は、接着面の表面粗さの影響を受けにくい、石英ガラスより成るプリズム同志を貼り合せる工程を有する光学部品の製造方法を提供することにある。

【0004】

【課題を達成するための手段】上記目的を達成するために本発明は、石英ガラスより成るプリズム同志を貼り合せる工程を有する光学部品の製造方法において、前記プリズム同志の接着を、シリコンアルコレートの加水分解生成物により行なうことを特徴とする光学部品の製造方法を提案するものである。

#### 【0005】

【実施例】以下、実施例に従い本発明を詳しく説明する。

【0006】図1はプリズム・タイプの偏光ビーム・スプリッターを示す模式図である。この偏光ビーム・スプリッターは、偏光ビーム・スプリッター膜3が成膜されたプリズム1ともう一つのプリズム2とがSi-アルコレートの加水分解生成物4により接着されて形成されたものである。

【0007】各プリズムは合成石英から成り、一方のプリズム1上に設けられた偏光ビーム・スプリッター膜3は誘電体の多層膜から成り、真空蒸着、スパッター、イオンプレーティング等により形成されたものである。この偏光ビーム・スプリッターの分光特性を図2に示す。図2で、5は反射率のP成分、6は反射率のS成分を示す。なお、この偏光ビーム・スプリッターはKRF・エキシマ・レーザー用のものである。

【0008】上記偏光ビーム・スプリッターの両プリズムを接着するために本発明ではSi-アルコレートを用いる。Si-アルコレートは、加水分解されることにより、ガラス状のSiO<sub>2</sub>となり接着能を呈するので接着剤として利用できる。しかもSi-アルコレートの加水分解生成物とプリズムを構成する石英ガラスとは同じ成分であるので、両者の屈折率が一致もしくはほぼ一致する上に両者の親和性も高く強い接着力を示す。

【0009】Si-アルコレートは種々のものが利用できるけれども、例えばエチルシリケートSi<sub>5</sub>O<sub>4</sub>(OC<sub>2</sub>H<sub>5</sub>)<sub>12</sub>等を選択すればよい。ただし他にもシリコントラエトキサイド: Si(O<sub>2</sub>C<sub>2</sub>H<sub>5</sub>)<sub>4</sub>等のSi<sub>n</sub>O<sub>n-1</sub>(OC<sub>2</sub>H<sub>5</sub>)<sub>2n+2</sub>に代表されるSi<sub>n</sub>O<sub>n-1</sub>(OR)<sub>2n+2</sub>(Rは置換または非置換の炭化水素基、nは1以上)やR<sub>n</sub>Si(OR)<sub>4-n</sub>等のSi-アルコラートが使用できる。

【0010】上に例示されたようなSi-アルコレートの加水分解の条件、触媒は特に制限はなく、常法に従って加水分解を実施すればよい。

【0011】加水分解後には溶媒のアルコール、もしくはエステルが残るが、低沸点のアルコール、エステル、(例えば、エチルアルコール、硫酸エステル等)は、接着後揮発する。より積極的にこれを除去するならば、加熱するか真空にすることで処理できる。また接着に際して接着面にゴミ、ホコリ等の異物や不純物が存在すると、接着強度が低下したり、レーザー損傷の原因になることから、接着においては、接着面を十分クリーニ

ングするとともに、接着剤を口過して用いるなど、不純物の除去が必要である。特に作業環境としては、クリーンルームが適している。

【0012】両プリズムを接着するために、Si-アルコレートの加水分解生成物を両プリズムの貼り合わせ面にコーティングする必要があるが、そのために例えば貼り合せの面に滴下、塗布して接着するなどの一般的な方法も利用できるけれども、接着層を1μm程度にまで薄くするために次の方法が好適である。即ち、両プリズムを接合し、その隙間にSi-アルコレートの加水分解生成物を注射器等を利用して注入して、毛細管現象により両プリズムの接合面全体に加水分解生成物を行き渡らせる方法である。この方法において、Si-アルコレートを接合面上にうまく広げ、かつ膜厚、膜の形成速度をコントロールするためにはSi-アルコレートに適当な粘性をもたらすことが必要である。これは金属アルコレートを適当に選択した溶液に溶解することにより実現できる。この溶液としては、例えばブチルアルコール等の高沸点アルコールやエステルが利用できる。

【0013】一般にSi-アルコレートは、加水分解後、加熱することによって、脱水、重合が進みSiO<sub>2</sub>非晶質膜へ変化し、光学部品の材料により近いものとなる。しかし、本発明、特にこの実施例では、加熱を行なわなくても、接着層は加熱をした場合と同等の光学的特性を示し且つ実用上十分な接着能を呈するので、加熱の必要はない。

【0014】本発明を、グラン・トムソン、グラン・ティラー、ウォラストン・プリズム等の製造に適用し、その構成部品をSi-アルコレートの加水分解生成物により接着することにより、従来よりも短波長領域側へより広い波長領域において使用できる各種のプリズムを提供することができる。

#### 【0015】

【発明の効果】以上詳細に説明したように、石英ガラスより成るプリズム同志の貼り合せに、接着剤としてSi-アルコレートの加水分解生成物を用いた本発明では、接着力が強く、しかも接着層と接着基体との屈折率が調和する。また、本発明では、オプティカルコンタクトを利用した場合に比べて、光学部品同志の接着力が接着面の粗さに影響を受けにくいという効果がある。

#### 【図面の簡単な説明】

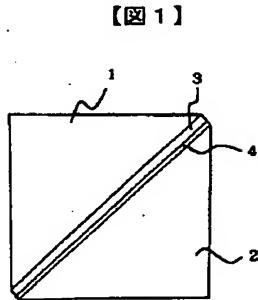
【図1】本発明の一実施例により製造されたプリズム・タイプの偏光ビーム・スプリッターの断面図である。

【図2】図1の偏光ビーム・スプリッターの分光特性を示す図である。

#### 【符号の説明】

1. 2 プリズム
- 3 プリズム1上に形成された偏光ビーム・スプリッターメン
- 4 Si-アルコレートの加水分解生成物の層

## 5 反射率のP成分



【図1】

## 6 反射率のS成分

【図2】

